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ABSTRACT

This guide describes standard operating job procedures for the digestion process of wastewater treatment facilities. This process is for reducing the volume of sludge to be treated in subsequent units and to reduce the volatile content of sludge. The guide gives step-by-step instructions for pre-startup, startup, continuous operating, shutdown, and preventive maintenance procedures. (BB)

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10

SOJP NO 10

DIGESTION

A GUIDE FOR THE DEVELOPMENT OF

STANDARD OPERATING JOB PROCEDURES

FOR WASTE WATER TREATMENT PLANT UNIT OPERATIONS

DEVELOPED BY
CHARLES COUNTY COMMUNITY COLLEGE
LA PLATA, MARYLAND

GRANT NO 900253
MANPOWER DEVELOPMENT STAFF,
ENVIRONMENTAL PROTECTION AGENCY.

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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SE 024 262

A GUIDE FOR THE DEVELOPMENT
OF
STANDARD OPERATING JOB PROCEDURES
FOR
WASTEWATER TREATMENT PLANT
UNIT OPERATIONS

BY

CHARLES COUNTY COMMUNITY COLLEGE

LA PLATA, MARYLAND

FOR

MANPOWER DEVELOPMENT STAFF

OFFICE OF WATER PROGRAMS OPERATIONS

ENVIRONMENTAL PROTECTION AGENCY

GRANT NO. 900253

MAY 1973

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A GUIDE FOR DEVELOPING

STANDARD OPERATING JOB PROCEDURES

FOR THE

DIGESTION

PROCESS

WASTEWATER TREATMENT FACILITY

SOJP NO 10

Developed by Charles County Community College under
a grant with the

Manpower and Training Staff
Office of Water Programs Operations
Environmental Protection Agency

Standard Operating Job Procedures for the Digestion

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SOJP NO 10 PAGE NO 1

Process Digestion

1. Operation Objectives

2. Brief Description of Process

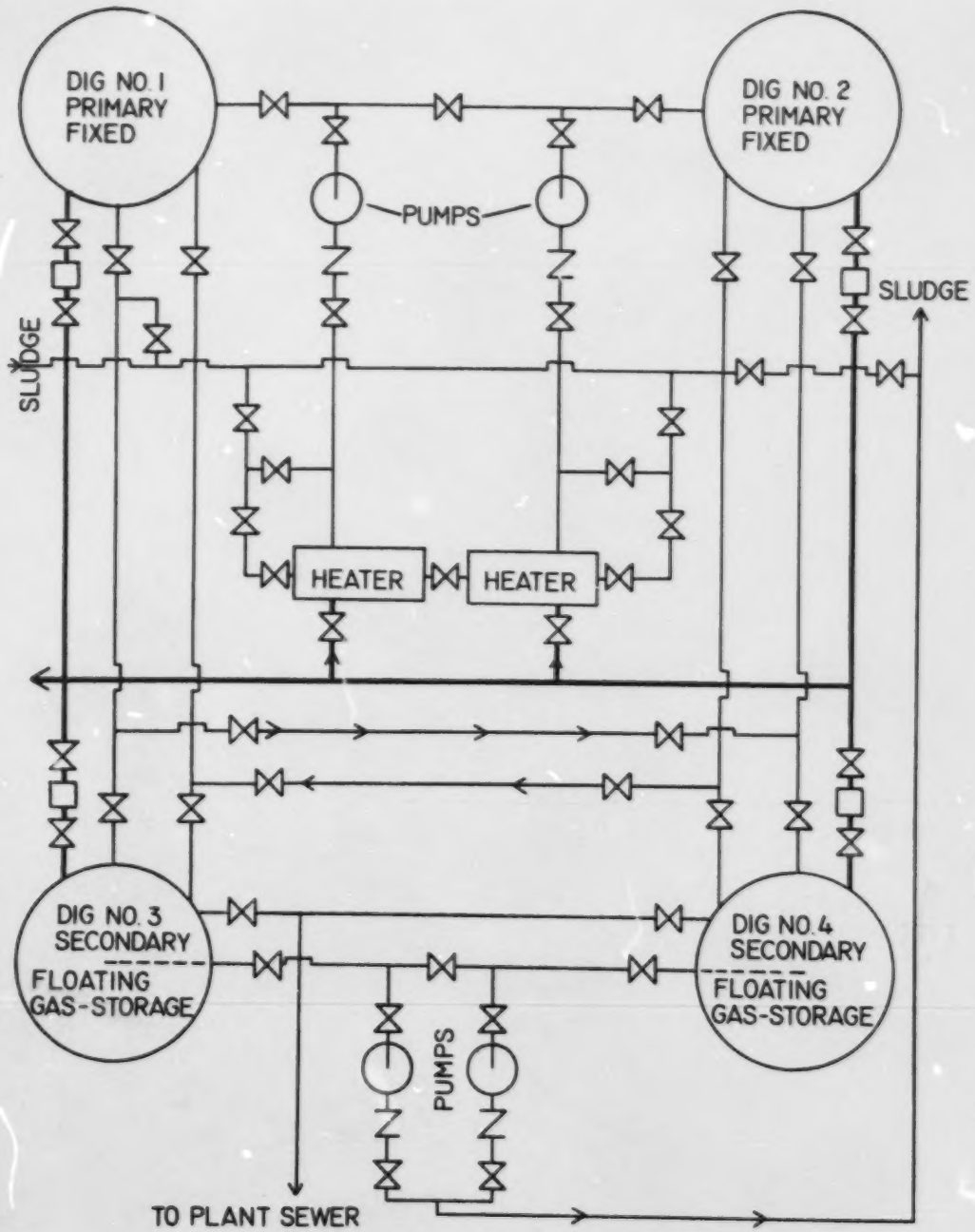
1. To reduce the volume of sludge to be treated in subsequent units and to reduce the volatile content of sludge.

2. Raw sludge from the primary sedimentation tanks or thickened sludge from the thickener is pumped to the primary digester where anaerobic bacteria destroy the more degradable volatile solids. The contents of the primary digesters are maintained at an even elevated temperature by means of an external heat exchanger Gas which is formed in the digestion process is utilized for heating the sludge and recarbonation. The contents of the primary digesters are mixed continuously by compressing a portion of the digester gas and diffusing the gas near the bottom of the tank.

   On a periodic basis sludge is transferred from the primary digesters to the secondary digesters where quiesent conditions permit solids to settle to the bottom and a liquid of relatively low solids content, supernatant, forms in the upper layer. The concentrated digested sludge is withdrawn periodically to the sludge disposal process. The supernatant is returned to either the head of the plant or to the aeration tanks for further treatment.

Process Digestion

Flow Sheet



Process Digestion

General Description of Equipment Used in the Process

Raw sludge from either the sludge thickener or the primary settling tanks is pumped to either of two primary digesters. Each digester is 70' in diameter with a SWD of 22 feet and a conical bottom of 6 feet depth. The raw sludge may be mixed with the recirculated sludge at the discharge of either of two heat exchangers.

The sludge in the primary digester can be recirculated through the heat exchanger continuously, not only for maintaining the proper sludge digestion temperature, but also to keep the contents of the digesters well mixed. The contents of the primary digesters are mixed continuously by compressing some of the gas which is produced and releasing it at the bottom of the digester. The point of discharge is selected by use of motorized valves operated on a timed sequence.

The elevation of the liquid in the primary digesters is maintained by the setting of rings in the overflow box. As raw sludge is added to the primary digester, an equal amount of sludge is transferred to the secondary digester.

Supernatant is withdrawn on a continuous basis by use of a supernatant selector or on a batch basis by opening valves on one of the supernatant draw off lines. The supernatant can be chlorinated before discharge to either the plant sewer or the aeration tank.

Digested sludge is withdrawn from either of the secondary digesters by the use of either or both of the digested sludge plunger pumps. The digested sludge is pumped to the sludge disposal building.

In addition to being used for recirculating the contents of the primary digester, gas produced in the digestion process is used to heat the heat exchangers which maintain the digestion temperature. The gas is also used to fire the sludge incinerator and for building heat throughout the plant. In order to equalize supply and demand, a given amount of sludge is stored under the floating gas holder covers of the secondary digesters. If these covers are at their maximum elevation and there still is an excess of gas, the excess can be disposed of by use of three waste gas burners located adjacent to the digester control building.

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
A. PRESTART UP INSPECTION PROCEDURES			
1. Safety Inspection	1. Make certain all valves are closed.	1. If valves' operation is not proper-stop	V.1
	2. Lock out all switch gear.		XII.1
2. Tank and Structure Inspection	1. Physically inspect the interior of all tanks for obstruction.	1. Remove all foreign objects such as containers, woodscraps, welding rods, ladders, etc.	XII.2
	2. Replace and seal all inspection parts.		V.8
	3. Check all lines for leaks.		
	4. Fill all digesters with water or raw sewage to operating level in primary digesters and just enough to float covers of secondary digesters.		XII.3
	5. Close vlaves listed in previous step.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
3. Equipment Inspection	1. Check all monometers for proper fluid.	1. Refer to Manufacturers bulletin	V.3
	2. Check all gas meters for proper operation.	1. Refer to Manufacturers bulletin	V.4, XI.1
	3. Check sludge recirculation pumps for proper operation.	1. Refer to Manufacturers bulletin	V.5
	4. Check sludge drawoff pump for proper operation.	1. Refer to Manufacturers bulletin	V.5
	5. Check heat exchangers for proper operation.	1. Refer to Manufacturers bulletin	V.6
	6. Check pressure and vacuum relief valves for proper operation.	1. Refer to Manufacturers bulletin	V.7 XII.4
	7. Check gas recirculation unit for proper operation.	1. Refer to Manufacturers bulletin	V.8 XII.4
4. Electrical Inspection	1. Check electrical switch gear for proper nomenclature and make certain explosion-proof fixtures are intact.	1. Refer to equipment maintenance records for overload heater proper size.	V.9 XII.5
	2. Unlock and activate switch gear.	1. Measure voltage at all points up to motor disconnect.	

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T.T. Schwing

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	3. Activate explosive gas detector and alarm system.	1. Refer to Manufacturers instructions.	V.10, XI.1 XII.6

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
B. STARTUP PROCEDURES			I.2
1. Primary Digester Startup	1. Heat #1 and #3 digesters to operating temperature.	1. To achieve goal, start up heat exchangers as outlined in O & M manual for this unit Open valves 4, 6, 7, 8, 9, and 10; start recirculation pumps 1 and 2. Auxiliary fuel will have to be used for this step	V.5
	2. Maintain digester at operating temperature.	1. To achieve this goad, by-pass heat exchanger by opening valves 18, 19, 20, and 21 and closing valves 7 and 8 until temperature drops 1°F and then go back to normal valve arrangement. Continue to recirculate the contents by the use of the recirculation pumps.	I.2
	3. Add seed sludge from a well operated digester.	1. Seed sludge should be about 20% of the volume of the digester being started up.	I.2
	4. Add sludge at the rate of 5 pounds of volatile solids per day/per 1000 cu.ft. of capacity.	1. Determine pH, total solids, volatile total solids, alkalinity and volatile acids on all sludge added to digesters.	III.1 VII.3 X.1

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	5. If gas production, pH, and alkalinity increase, increase the sludge feed rate to 10 pounds of volatile solids per day/per 1000 cu.ft. of capacity. This may take 60 days. If good digestion operation continues, increase sludge feed at increments of 5 pounds of volatile solids/per day/per 1000 cu.ft. of capacity until a loading of 50 pounds of volatile solids per day/per 1000 cu.ft. is achieved.	1. The pH should rise to approximately 6.8-7.2; alkalinity should increase to about 1800 ppm. SPECIAL NOTE: In general do not expect the volatile acids to drop until organic feed rate is stabilized.	III.1 VI.1 VII.1 & 3 VIII.1 X.1
	6. When sufficient gas is available, start up gas recirculation unit.	1. See manufacturers operations bulletin. WARNING: Do not permit digester gas pressure to fall below 0.5" W.C.	V.8, VII. 1 & 3 VIII.1 XII.7
	7. After initial digester is in operation, make all transfers to other primary unit and proceed through steps B.1 through B.6 above.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	8. After both primary digesters are successfully operating, make transfers to secondary digesters.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
C. CONTINUOUS OPERATING PROCEDURES			
1. Continuous Shift Operation	1. Pump raw sludge for thickener or other units on a continuous basis if at all possible.		I.2
	2. Grab sample and composite.		III.1 VIII.1 X.1
	1. Raw sludge pumped	1. Sample should be analyzed for pH, total solids, volatile total solids.	
	2. Transfer sludge	2. Sample should be analyzed for pH, total solids, volatile total solids.	
	3. Digested sludge	3. Sample should be analyzed for pH, total solids, volatile total solids.	
	4. Supernatant	4. Sample should be analyzed for pH, total solids, volatile total solids.	
	5. Gas	5 Sample should be analyzed for methane concentration.	VII.2
	3. Observe operation of heat exchangers for proper temperature.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	4. Observe operation of all pumps for proper operation.		
	5. Observe operation of gas recirculation units for proper operation.		
2. Every 4 Hours	1. Record the following meter readings: 1. Volume of gas from each digester. 2. Volume of gas to waste. 3. Volume of gas to other process units. 4. Volume of raw sludge to digester. 5. Volume of digested sludge from digester. 6. Volume of super-natant.		IV.1, XI.1 XIII.1

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	2. Record the following monometer readings:		IV.1 XIII.1
	1. Each digester		
	2. Service line		
	3. Waste line		
	3. Record the elevation of the floating covers.		
3. Every Shift	1. Place composite samples in central sample storage.		IV.1, X.1
	2. Complete shift report.		IV.1 XIII.1
4. Daily	1. Replace recorder charts.		IV.1, XI.4 XII.1
	1. Carefully calculate 24 hour flows.		
	2. Check recorder pen for proper inking.		
	2. Complete daily and monthly log sheets.		IV.1 XIII.1

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
D. SHUT DOWN PROCEDURES			
1. The Shut Down Procedure is for taking the digester out of service for cleaning.	1. Stop feeding raw sludge or transferring sludge to the unit at least one week prior to expected shut down date. 2. When gas production has fallen off to a minimum, close gas valve. 3. Open hatches to atmosphere. 4. If primary digester, pump sludge to other primary and/or secondary digesters. 1. If secondary digester, withdraw as much supernatant as possible back to plant.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	5. Pump digested sludge to disposal as long as possible.		
	6. When sludge can no longer be withdrawn by normal pumping, ventilate digester space above liquid by discharging fresh air into digester.	WARNING: Do Not enter digester unless equipped with breathing apparatus.	
	7. Use Stang deluge nozzle or five hoses to break up sludge, scum, and grit deposit.		
	8. Recirculate contents with trash pump.		
	9. Pump homogenized sludge to disposal.		
	10. When digester is empty, continue ventilation and then do inspection for determining maintenance required.		
	11. After required maintenance, go back to startup procedures.		

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
E. PREVENTIVE MAINTENANCE (MAY BE DONE BY OTHERS)			
1. Equipment Maintenance	1. Inspect pumps	1. See Manufacturers O & M Manual	IV.1, V, IX.1 XIII.1
	2. Lubricate motors	1. See lubrication schedule for proper lubricant and interval.	IV.1, V, IX.1 XIII.1
	3. Check motor electrically	1. Record: 1. Voltage 2. Amperage 3. Insulation resistance	IV.1, V, IX.1 XIII.1
	4. Inspect switch gear annually.		IV.1, V IX.1 XIII.1
	5. Inspect pressure relief valves annually.	1. See Manufacturers O & M Manual	IV.1, V IX.1 XIII.1
	6. Inspect all flame arresters annually.	1. See Manufacturers O & M Manual	IV.1, V IX.1 XIII.1
	7. Calibrate flow meters.	1. See Manufacturers O & M Manual	IV.1, V IX.1, XI.1 XIII.1

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OPERATING PROCEDURES	STEP SEQUENCE	INFORMATION/OPERATING GOALS/SPECIFICATIONS	TRAINING GUIDE NOTE
	8. Inspect heat exchangers annually.	1. See Manufacturers O & M Manual 2. Notify fire underwriters inspector in sufficient time for inspection of dewatered unit.	IV.1, V IX.1 XIII.1
	9. Paint floating covers as necessary.		IV.1, V IX.1 XIII.1

TRAINING GUIDE

SECTION	TOPIC
I	Operating Theory
II	Educational Concepts - Mathematics
III	Educational Concepts - Science
IV	Educational Concepts - Communications
V	Process Equipment
VI	Process Flow - Characterization
VII	Process Control
VIII	Abnormal Operations - Trouble Shooting
IX	Maintenance Practices
X	Laboratory Practices
XI	Instrumentation - Automation
XII	Safety Practices
XIII	Records Reports

OPERATING THEORY

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
I.1 (General)	Sludge Digestion	WPCF MOP #11 Chapters 9 and 10 WPCF MOP #11 Chapters 7 and 12 WPCF MOP #8 Chapter 14 Texas Manual Chapters 18 and 23 New York Mannual pp. 85-96 Chapter 9
I.2 (B) (B1.2.1) (B.1.3.1) (C.1.1)	Digester Startup Procedure	JWPCF - 31, 1, 117, 31, 2, 123 31, 10, 1230 35, 5, 626 39, 3, 367

EDUCATIONAL CONCEPTS - MATHEMATICS

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
	VOLUME:	
	V = V cylinder + V cone	
	V = AH cylinder + AH cone	
	$= \pi/4D^2H + 1/3\ \pi/4D^2H$	
	$= .785(70)^2\ 22 + 1/3\ .785(70)^2 6$	
	= 92,316 cf	
	= 92,316 x 7.48 gal/cf = 690,524 gallons	
	DETENTION TIME:	
	$T = \frac{V}{Q}$	
	$= \frac{690,524 \text{ gallons}}{30,875 \text{ gpd}} = 22.4 \text{ days}$	
	LOADING:	
	$\frac{\text{Pounds of Volatile Solids Fed Per Day}}{\text{Thousands of Cubic Feet of Capacity}}$	
	$= \frac{25,750 \text{ ppd x .70 Volatile}}{2 \text{ digesters x } 92.3 \text{ thousands cf}}$	
	= 97.6 # volatile solids/day/1000 cf	

EDUCATIONAL CONCEPTS - SCIENCE

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
III.1 (B.1.4.1) (B.1.5.1) (C.1.2)	1. Determination of pH	New York Manual pg 132, Ref. 1 Ch. 15 Ref. 3 pg 230
	2. Sludge Solids Test	New York Manual pg. 134, Ref. 1 Ch.27
	3. Biochemical Oxygen Demand Test	New York Manual pg 139, Ref. 1 Ch. 24 Ref. 3 pg 15
	4. Suspended Solids Test	New York Manual pg 135, Ref. 3 pg 278
	5. Total Solids Test	New York Manual pg 136, Ref. 3, pg 280
	6. Volatile Acids Test	New York Manual Ref. 1 Ch. 33, Ref. 2 part 233, Ref. 3 pg 280
	7. Alkalinity Test	New York Manual Ref. 1 Ch. 17, Ref. 2 part 201, Ref. 3 pg 6, 8
	8. Gas Composition	New York Manual Ref. 1 Ch. 34
	9. Heavy Metals	New York Manual Ref. 2 part 225, Ref. 2 part 211, Ref. 3 pg 83-121
Ref. 1	Chemistry for Sanitary Engineers, Sawyer, E.N. & McCarty, P.L., McGraw-Hill Book Co.	
Ref. 2	Standard Methods for the Examination of Water & Wastewater, 13th Edition, APHA	
Ref. 3	Methods for Chemical Analyses of Water & Wastes, EPA, WQO, 1971.	

EDUCATIONAL CONCEPTS - COMMUNICATIONS

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
IV.1 (C.2.1) (C.2.2) (C.3.1) (C.4.1) (C.4.2) (E.1.1-9)	1. Plant Daily Operating Sheet-Section 10 2. Maintenance Report (Trouble) 3. Preventive Maintenance File Cards 4. Equipment Inventory Cards 5. Foreman's Daily Report 6. Plant Operating Log	

PROCESS EQUIPMENT

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
V.1 (A.1.1.1) (E.1.1-9)	Valves	Equipment Manufacturer's O & M Manual, Blue Prints and Shop Drawings
V.2 (A.2.1.1) (E.1.1-9)	Digestor Structure	Equipment Manufacturer's O & M Manual
V.3 (A.3.1.1) (E.1.1-9)	Manometer	Equipment Manufacturer's O & M Manual
V.4 (A.3.2.1) (A.3.4.1) (E.1.1-9)	Gas Meters	Equipment Manufacturer's O & M Manual
V.5 (A.3.3.1) (E.1.1-9)	Pumps	Equipment Manufacturer's O & M Manual
V.6 (A.3.5.1) (B.1.1.1) (E.1.1-9)	Heat Exchangers	Equipment Manufacturer's O & M Manual
V.7 (A.3.6.1) (E.1.1-9)	Pressure and Vacuum Relief Valves	Equipment Manufacturer's O & M Manual
V.8 (A.3.7.1) (A.2.2) (B.1.6.1) (E.1.1-9)	Gas Recirculation Unit	Equipment Manufacturer's O & M Manual
V.9 (A.4.1.1) (E.1.1-9)	Electrical Switch Gear	Equipment Manufacturer's O & M Manual
V.10 (A.4.3.1) (E.1.1-9)	Explosive Gas Detector	Equipment Manufacturer's O & M Manual

PROCESS FLOW - CHARACTERIZATION

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
VI.1 (B.1.5.1)	The pH of a well operating digester will stabilize at some point between 6.8 and 7.2. The alkalinity is dependent upon the total solids content. The higher the total solids, the higher the alkalinity. In general a digester with a total solids content of 3% will have a proper operating alkalinity of 1800 ppm; if the total solids increases to about 8% the alkalinity should be about 3000 mg/l. During digester start up, the volatile acids may be in the 2000 mg/l range; if higher values are obtained, take corrective action. During digester start up the gas produced will be high in CO_2 content, as the digester reaches equilibrium the CO_2 content will approach 30% with approximately 68% methane.	

PROCESS CONTROL

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
VII.1 (B.1.5.1) (B.1.6.1)	Control Guides	WPCF, 35, 1, 11
	Volatile Acids as Control Indicators	WPCF, 35, 12, 1501
VII.2 (C.1.2.5)	Daily obtain sample of digestor gas for analysis. Use gas partitioner or Orstat apparatus for analysis. If methane concentration changes in excess of two percentage points, attempt to correlate with other analysis and take corrective action.	
VII.3 (B.1.4.1) (B.1.5.1) (B.1.6.1)	In general during start up it is highly recommended that pH, alkalinity, volatile acids, gas production and % methane be plotted on a graph each day.	

ABNORMAL OPERATIONS - TROUBLE SHOOTING

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
VIII.1 (B.1.5.1) (B.1.6.1) (C.1.2-5)	If difficulty in maintaining a proper pH, alkalinity, and volatile acids content in the start up period, anhydrous ammonia or lime may be added to raise the alkalinity and pH.	
	Prevention of heavy metal-toxicity by sulfides	WPCF, 37, 3, 392

MAINTENANCE PRACTICES

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
IX.1 (E.1.1-9)	1. Organization and Administration of the Maintenance Forces	Morrow, Sec. 1
	2. Planning and Scheduling Maintenance Works	Morrow, Sec. 3
	3. Costs and Budgets for Maintenance Operation	Morrow, Sec. 5
	4. Maintenance of Electrical Equipment	Morrow, Sec. 7
	5. Maintenance of Mechanical Equipment	Morrow, Sec. 8
	6. Maintenance of Service Equipment	Morrow, Sec. 9
	7. Lubricants and Lubrication	Morrow, Sec. 12
	Morrow, L.C., Maintenance Engineering Handbook, McGraw-Hill, New York, 1966, 2nd Edition.	

LABORATORY PRACTICES

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
X.1 (B.1.4.1) (B.1.5.1) (C.1.2.1 -5) (C.3.1)	Whenever liquid is flowing into or out of any digester it should be sampled. Raw sludge and transfer sludge should be sampled every hour with a 100 ml sample being placed into a one quart jar. Supernatant and digested sludge should be sampled every 30 minutes with a 100 ml sample being placed into a properly marked one quart jar. Samples should be composited on a shift basis. Each shift, samples collected should be taken to a central refrigerated storage area for lab personnel. Be sure to mark source and date. Gas samples should be collected in an appropriate gas bomb by laboratory personnel.	

INSTRUMENTATION - AUTOMATION

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
XI.1 (A.3.2.1) (A.4.3.1) (C.2.1) (C.4.1) (E.1.7.1)	Instruments and Instrumentation Instrumentation and Control in Water Supply and Wastewater Proposal, Russell H. Babcock, P.E., Reuben H. Donnelby Corporation	Morrow, Sec. 13 Shop Drawings Manufacturers O & M Manual

SAFETY PRACTICES

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
XII.1 (A.1.2)	Make certain circuits are "Dead" and locked and tagged out to prevent electrical shock.	WPCF MOP #11 Chapter 20
XII.2 (A.2.1.1)	Use care setting ladders in tanks with inclined bottoms to prevent falls. Use care when walking on inclined bottoms to prevent falls.	
XII.3 (A.2.4)	Covers must be floated and water covering sampling lines and overflow lines so as to prevent the escape of gas or entrance of air. An explosive mixture could result.	
XII.4 (A.3.5-7)	Observe all safety precautions listed in manufacturer's bulletin.	
XII.5 (A.4.1.1)	Explosion proff fixtures must be intact in order to contain any possible explosion.	
XII.6 (A.4.3.1)	Do not over-ride detector.	
XII.7 (B.1.6.1)	If insufficient gas is available to maintain the reci4culation rate and the unit is shut down while the gas pressure is below 0.5 " W.C., air may be drawn into the digester through the vacuum relief valve.	

RECORDS - REPORTS

TRAINING GUIDE NOTE	TRAINING INFO: THEORY/CONCEPTS/CALCULATIONS/ TECHNIQUES	REFERENCES/INSTRUCTIONAL RESOURCES
XIII.1 (C.2.1) (C.2.2) (C.3.2) (C.4.1) (C.4.2) (E.1.1-9)	**Plant Daily Operating Sheet** 1. Raw sludge to Digester #1 GALLONS 2. Raw sludge to Digester #3 GALLONS 3. Transfer sludge from Digester #1 GALLONS 4. Transfer sludge from Digester #3 GALLONS 5. Transfer sludge to Digester #2 GALLONS 6. Transfer sludge to Digester #4 GALLONS 7. Supernatant from Digester #2 GALLONS 8. Supernatant from Digester #4 GALLONS 9. Digested sludge from Digester #2 GALLONS 10. Digested sludge from Digester #4 GALLONS 11. Temperature Digester #1 °F 12. Temperature Digester #3 °F 13. Gas Pressure INCHES W.C. a. Digester #1 INCHES W.C. b. Digester #2 INCHES W.C. c. Digester #3 INCHES W.C. d. Digester #4 INCHES W.C. e. Waste Gas Burner INCHES W.C. f. Service Line INCHES W.C. 14. Gas Flow S.C.F. a. From Digester #1 S.C.F. b. From Digester #3 S.C.F. c. From Digester #2 S.C.F. d. To Digester #2 S.C.F. e. From Digester #4 S.C.F. f. To Digester #4 S.C.F. g. To waste S.C.F. h. To service S.C.F. **Plant Monthly Operating Log** 1. Raw sludge to Digester #1 GALLONS 2. Raw sludge to Digester #3 GALLONS 3. Transfer sludge to Digester #2 GALLONS 4. Transfer sludge to Digester #4 GALLONS 5. Supernatant from Digester #2 GALLONS 6. Supernatant from Digester #4 GALLONS 7. Digested sludge from Digester #2 GALLONS 8. Digested sludge from Digester #4 GALLONS 9. Total Gas Production S.C.F. 10. Gas Utilized in Plant S.C.F. 11. Gas Wasted S.C.F.	